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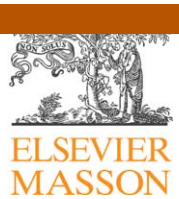

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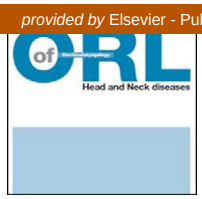

SURGICAL TECHNIQUE OR TECHNOLOGY

Free anterolateral thigh flap for reconstruction of upper aerodigestive tract defects

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Introduction

The free anterolateral thigh flap, described by Song et al. in 1984 [1], is a perforator flap harvested from the anterolateral side of the thigh. This fasciocutaneous flap is vascularized by a branch of the deep femoral artery.

Its use is rare in France for upper aerodigestive tract defect reconstruction, especially because of its thickness and of anatomical variations in the perforators. It has, however, many advantages over antebrachial fasciocutaneous flaps with radial pedicle, including a resistant fascia and reduced donor site sequelae.

We describe the harvesting technique and potential indications.

Anatomy

The free anterolateral thigh flap is vascularized by one or more septo- or musculocutaneous perforators originating from the descending branch of the lateral circumflex artery of the thigh, which is a branch of the deep femoral artery (Fig. 1). This artery is accompanied by one or two veins along its entire length.

In its superior third, the descending branch of the lateral circumflex artery runs obliquely, lateral to the vastus medialis muscle, in the septum between the vastus lateralis and right femoral muscle. It is easily located by retracting the right femoral muscle inward. In its mid-third, it runs under the insertions of the vastus lateralis and vastus medialis. The vastus lateralis motor nerve is posterolateral to the vessels.

Perforator topography was classified by Shieh et al. [2] according to origin and direction:

- type 1: musculocutaneous perforators with vertical direction, originating from the descending branch of the lateral circumflex artery (56.8%);
- type 2: musculocutaneous perforators with horizontal direction, originating from the transverse branch of the lateral circumflex artery (27%);
- type 3: septocutaneous perforators with vertical direction, originating from the descending branch of the lateral circumflex artery (10.8%);

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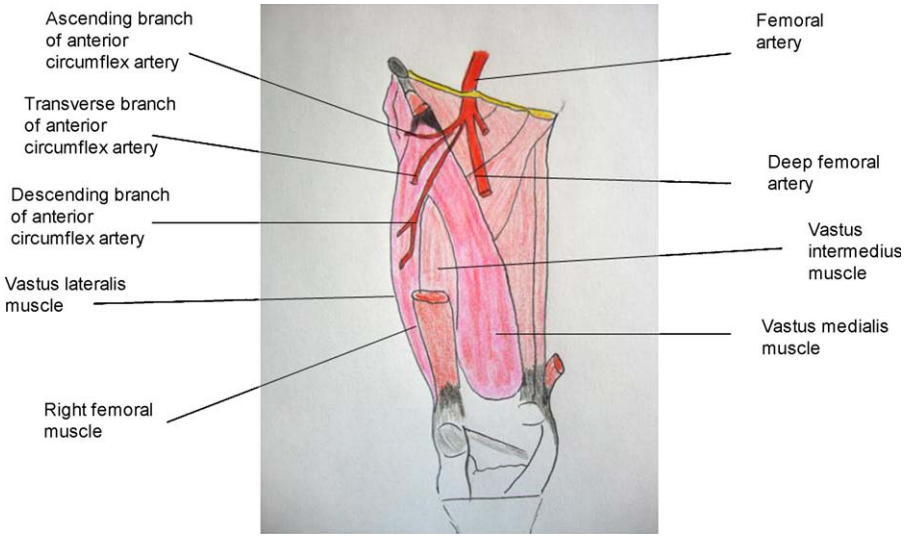

Figure 1 Anatomy of the lateral region of the thigh.

- and type 4: septocutaneous perforators with horizontal direction, originating from the transverse branch of the lateral circumflex artery (5.4%).

In most cases (93%), the perforator originates from the middle of the line between anterosuperior iliac crest and superolateral edge of the patella [3].

Perforator artery distribution in each limb is not necessarily symmetrical in a given patient. Pre-operative assessment of vascular axes should be bilateral.

Pre-operative assessment

It is strongly advisable to locate the perforators pre-operatively, although some surgeons consider that a careful surgical exploration is sufficient.

Doppler is a reliable and inexpensive examination. It is widely used, but does not precisely determine perforator trajectory or, in particular, definitively distinguish septal and muscular variants or assess muscular trajectory length.

CT, recommended by some authors, is better adapted [4], determining perforator number, caliber and type (septocutaneous or musculocutaneous) and location with respect to a line between the anterosuperior iliac crest and the superolateral patellar angle. It would thus seem to be the reference pre-operative examination in free anterolateral thigh flap.

Surgical technique

The patient is installed in a supine position, as for oncologic upper aerodigestive tract surgery. The surgical field extends from the inferior half of the abdomen to the patella, with the lower limb left free.

Two teams can work simultaneously, one on exeresis and head-and-neck site preparation, and the other on flap harvesting.

The pedicle axis is located on a line drawn from the middle of the segment between the anterosuperior iliac crest and the superolateral edge of the patellar on the one hand to the middle of the inguinal ligament on the other.

The CT angiography data are transferred with respect to the anterosuperior iliac crest/patella line. The medial edge of the skin paddle is traced so as to include the perforator arteries.

The incision is prolonged as a lazy S along the pedicle trajectory (Fig. 2).

Incision begins on the medial side of the skin paddle, and goes through skin, subcutaneous tissue and muscle fascia. The perforator is located using blunt dissection on the deep side of the fascia. Skin is fixed to aponeurosis with separated stitches, to avoid sliding.

Retrograde dissection of the perforator in its septal or muscular trajectory is completed up to the origin of the lateral circumflex artery of the thigh. If the perforator has a muscular trajectory, a muscular surround is conserved to protect the pedicle (Fig. 3).

An alternative technique is first to seek for the descending branch of the anterior circumflex artery between vastus lateralis and right femoral muscle, on their deep side.

Figure 2 Drawing of flap, with perforators traced using CT data.

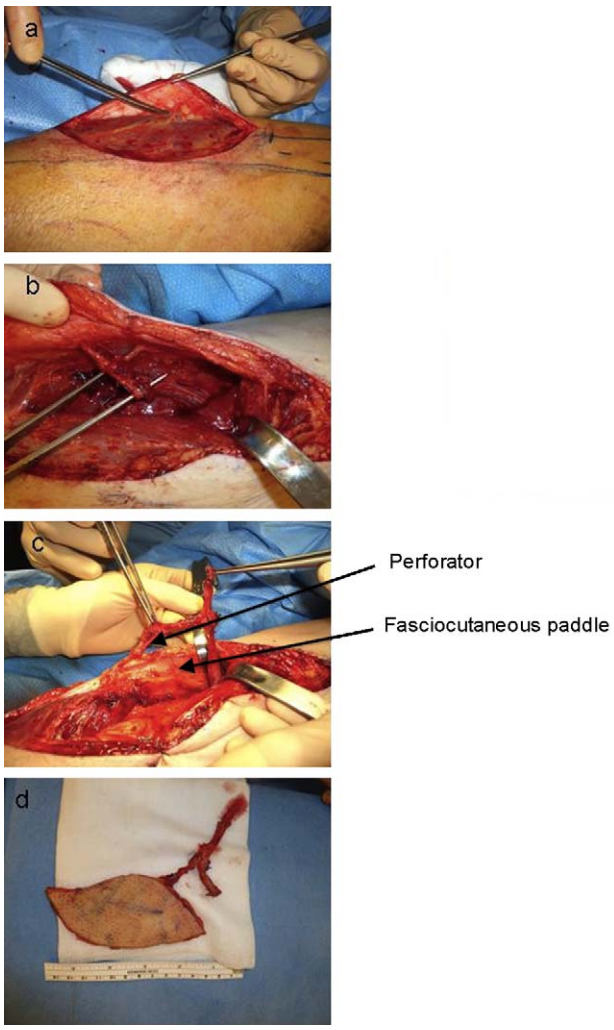

Figure 3 a: Location of the perforator artery under the fascia; b: careful intramuscular or intraseptal dissection of the perforator artery; c: retrograde dissection of the pedicle to its origin; d: harvested flap.

Perforators are then dissected forward to check for cutaneous determination and contour the paddle.

Retrograde dissection of the pedicle continues along the descending branch of the lateral circumflex artery of the thigh, in the space between vastus lateralis and right femoral muscles. The vastus lateralis motor nerve is conserved along the trajectory.

All muscular collaterals up to the origin of the pedicle are clipped. Pedicle components (generally, one artery and two veins) are separated at their origin for two to three centimeters.

The skin paddle is incised around the perforator and sized to match the defect.

The flap is not detached until the recipient vessels have been prepared, ensuring good vascularization of the whole skin paddle.

The flap is harvested after ligating the pedicle distally and then proximally, and rinsed in heparinized serum.

The muscle is sutured with separated sutures over an aspiration drain.

The skin is closed, usually by simple apposition, over a superficial aspiration drain. Subcutaneous detachment of the thigh should be limited, to avoid seroma. If direct closure is not possible (flap wider than 9 to 10 cm), the thigh defect is covered with a split-thickness skin graft.

Discussion

Anterolateral thigh flap is an alternative to antebrachial fasciocutaneous flap in upper aerodigestive tract defect reconstruction. Its reliability has been confirmed in large clinical series, especially in oropharyngeal reconstruction [5]. Indications are broad: tongue, cheek or hypopharynx [6]. This perforator flap has many advantages [7].

The lateral circumflex artery of the thigh shows few anatomic variants. It is subject to atheromatous disease, like the deep femoral network. Its length (more than 10 cm) allows direct connection to the cervical region, with no need of vascular graft. Its diameter (more than 2 mm) makes surgical anastomoses easier. The satellite veins are consistent: two veins of considerably wider diameter than those used in antebrachial flaps (radial and cephalic veins).

The flap is supple, but structured by a solid aponeurosis. This solid anchor point, stable over time, limits the subsidence (the ''flag'' effect), which impairs antebrachial flaps, especially in palate reconstruction [8].

Indications in isolated soft palate reconstruction are more debatable. Folding the flap back on itself (to reconstruct the nasal and buccal planes) may threaten flap vascularization. The thickness (almost always thinner than in antebrachial flaps) may hinder upper airway permeability.

In hypopharyngeal reconstruction, the anterolateral thigh flap is a good alternative to digestive, jejunal or gastro-epiploic flaps [9]. It avoids laparotomy morbidity without affecting the incidence of postoperative stenosis (6%) or pharyngeal fistula (9%) [5]. It can be harvested with a vastus lateralis muscle fragment to cover and thus protect the digestive suture [9]. Functional rehabilitation with vocal prosthesis seems to work better than with jejunal flaps [5]. A large skin paddle is available. In theory, almost the entire anterolateral side of the thigh can be harvested [6]. The paddle may be segmented if several perforators have been identified: this is especially useful in hypopharyngeal reconstruction associated to cervical radiodermatitis. In these indications, a flap is used for digestive reconstruction and skin coverage [5,7]. Using an antebrachial flap, this is not feasible without leaving severe forearm sequelae.

The anterolateral thigh flap does not sacrifice any major vascular axis, unlike antebrachial or fibular flaps. Esthetic sequelae are slight, unlike antebrachial flaps that leave socially exposed sequelae on the medial forearm.

Anterolateral thigh flap harvesting is somewhat more difficult than antebrachial flap, the main problem being dissecting the intramuscular trajectory of the perforator; a magnifying lens is recommended.

The main drawback of the anterolateral thigh flap is thickness in European or North American patients. The adipose panniculus of the thigh is thick even in thin subjects, and especially in women. Thinning at harvesting has been

suggested, but is not advisable, as this threatens skin paddle vascularization and increases the rate of complications [10]; it is more often performed secondarily.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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